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(54) Title: DATA TRANSMISSION IN A CELLULAR COMMUNICATIONS SYSTEM

(57) Abstract: A method of transmitting data in a cellular communication system. The method includes receiving requests from a plurality of user stations, forming a request group consisting of those requests that specify a same item of data, and transmitting the same item of data by a common transmission resource. A transmitting step can be performed at a time determined according to a number of requests in the request group and/or transmission time criteria specified in the requests. Also described is a corresponding apparatus for transmitting data. Also described is a storage medium storing processor implantable instructions. The invention reduces the amount of transmission resource used.

DATA TRANSMISSION IN A CELLULAR COMMUNICATIONS SYSTEM

FIELD OF THE INVENTION

The present invention relates to the transmission of data in a cellular communications system, more particularly the transmission of specifically requested items of data. The present invention is applicable to, but not limited to, cellular communications systems such as the Global System for Mobile Communications (GSM), and also the Universal Mobile Telecommunication System (UMTS) currently under standardisation.

BACKGROUND OF THE INVENTION

One type of communications system is a cellular communications system. In a cellular communications system, the area over which service is provided is divided into a number of smaller areas called cells. Typically each cell is served from a base transceiver station (BTS) which has a corresponding antenna or antennas for transmission to and reception from a user station, often a mobile station. An established harmonised cellular radio communications system is the Global System for Mobile Communications (GSM). A further harmonised standard currently being defined is the Universal Mobile Telecommunications System (UMTS), which is intended to provide a harmonised standard under which cellular radio communications networks and systems will provide enhanced levels of interfacing and compatibility with other types of communication systems, which in addition to speech and data services, will include extensive provision for multimedia communications. It is also expected that, within the framework of developments such as UMTS or the like, cellular radio communications system will play an increasing role in information highways such as the Internet.

Advantages to be provided by systems such as UMTS will be increased flexibility, increased levels of interaction, improved data flow for traffic, and increased provision of data from service providers to users. Users will generally have correspondingly higher levels of expectation. Consequently, although systems such as UMTS will theoretically provide increased levels of transmission resource, bandwidth etc, compared to current systems, nevertheless parallel increases in flexibility and types of data required by users will continue to place strong practical pressures on the availability and capacity of transmission resource (or bandwidth resource). Another development which is expected to place increasing demands on transmission or bandwidth resource is the concept of a software defined radio (SDR). In cellular communications systems, mobile stations such as mobile telephones or other mobile terminals are a form of radio apparatus. In a software defined radio some degree of the functionality of that radio is provided in a form that can be reconfigured by means of providing configuration data/software which when implemented in the radio apparatus provides that apparatus with alternative or additional functionality. This is to be distinguished from a radio apparatus in which a user is able to define a choice of functionality, the various functionalities however already being present in the apparatus. For example, a software defined radio might initially be configured to operate as a Time Divisional Multiple Access (TDMA) mobile telephone, but would have circuitry and processing means able to receive configuration data that when assimilated into the telephone provides the telephone with a functionality or capability to be a Code Divisional Multiple Access (CDMA) telephone. Different degrees of such configuration data or software provision exist, from small top-ups to be added to the operating software of the telephone's original functionality through to completely new arrangements. However, whichever degree is the case, a common point is that functionality is provided to the telephone, in other words brought into the telephone, that was previously not

there before the configuration software was downloaded. A known means of downloading such software is to employ a transmission resource within the cellular communication system in which the software defined radio apparatus operates. Use of software defined radio apparatus will therefore give rise to a further problem related to use of a network's transmission resources.

A known way of reducing the number of separate downlink channels required to be used in a cellular communications system when transmitting the same information to a number of users is that known as 'cell-broadcast'. Cell-broadcasting conventionally employs a manually configured channel to broadcast information of common interest to subscribers such as news or travel updates. As the name implies, such cell broadcasts are inherently transmitted continuously or repeatedly, over a whole cellular communication system, in a 'blind' fashion, giving undesirable waste of transmission resource.

SUMMARY OF THE INVENTION

The present invention provides a means for transmitting the same information to a number of users, via a common transmission resource, by analysing requests for data from a plurality of users and forming a pool or group of requests for the same item of data. In this way the item of data need not be transmitted if no such group is formed, hence use of transmission resource is reduced or eliminated.

In a preferred version of the invention, the common transmission is timed according to the number of requests received for a specific item of information or data.

In a further preferred version, requirements input by users, such as maximum permitted delay times, preferred receipt times, and so on, can form alternative

or additional features for determination or planning of a common transmission. Determination of the time a transmission is made using a common transmission resource of a cellular communications system can be based on an algorithm, preferably an adaptive algorithm employing functions or relationships that vary with respect to time, preferably defined in relation to acceptable delay to particular users or number of requests required or time of day or week, or combinations thereof.

In another preferred version of the invention, preparation information is transmitted to user terminals, on one-to-one communications links whereby the preparation information is used by the user terminal to automatically facilitate receipt of the common transmission. Alternatively, the preparation information may be converted into a user understandable form, such that a user can facilitate or prepare for receipt of the common transmission.

In yet another preferred version, users may manually initiate requests as to the status of their original request. For example, the user may enquire of the number of similar requests held by the central process, or maximum delay expected, and so on. Such status requests are alternatively initiated automatically by the user terminal.

In yet another preferred version, power control settings are set for the common transmission according to power level details of user stations which have provided the data requests.

Movement of mobile users is accommodated in a further version of the invention by altering request groups accordingly as users move from cell to cell. Movement in and out of microcells or picocells is similarly accommodated, as is movement between any hierarchy of geographical or other service area constraints, such as from one visitor registration area to another.

The present invention is particularly advantageously applied to requests for items of data which consist of software to be downloaded to a software defined radio.

The present invention reduces the bandwidth or capacity needed to transmit a specific common item of information or data to a plurality of users, by intelligently processing requests for data from users. Requests for the same item of information are pooled, and a common transmission made according to an automatic decision making process. Redundant transmission is thus reduced, and a separate dedicated channel need not be used for each user. This can advantageously lead to reduction in cost per user.

Additional specific advantages are apparent from the following description and figures.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic illustration of a communications system in accordance with the present invention.

Figure 2 is a schematic illustration of a software defined radio in accordance with the present invention.

Figure 3 is a process flow chart of an embodiment of the present invention.

Figure 4 is a schematic illustration of processing information as employed in an embodiment of the present invention.

Figure 5 is a schematic illustration of a further communications system in accordance with the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The embodiments are hereinafter described by way of example only. The first embodiment will now be described with reference to Figures 1 to 4.

Figure 1 shows a cellular communications system 100 including a plurality of user stations. The number of user stations is likely to be in the hundreds or thousands, of which only three are shown in Figure 1 by way of example, namely user stations 102, 104 and 106. In the present example each user station 102,104 and 106 is a mobile station, more particularly a mobile telephone consisting of software defined radio apparatus configured with appropriate functionality. Communication links consisting of radio links 122,124 and 126 are employed between a base station system (BSS) 110 and user stations 102,104 and 106 respectively. In the present embodiment a base station controller (BSC) and a base transceiver station (BTS) are co-located to form BSS 110. Alternatively, the BSC and the BTS may be located separately. A geographical area served by BSS 110 constitutes one cell of the cellular radio communications system.

BSS 110 is connected to a Mobile Services Switching Centre (MSC) 120, which in turn is connected to a Public Switched Telephone Network (PSTN) 130. PSTN 130 can be connected to any other information or communication network.

In the present embodiment items of data which are to be transmitted consist of software which is to be downloaded to the software defined radios constituting the user stations 102,104 and 106. In the present embodiment various packages of software are made available by the operator of the cellular

communications system for provision to the software defined radio user stations. The operator of the cellular communications system has functional control of MSC 120 and BSS 110, and controls provision and transmission of this data centrally from MSC 120.

The software defined radio user stations 102,104 and 106 will now be described in more detail with reference to Figure 2. Each user station is a mobile telephone. Each includes a processor 250. Processor 250 is coupled to each of memory 240, input/output device 235, keyboard 230, display 225 and modem 245. The modem 245 is further coupled to transmit/receive apparatus 220 which is further coupled to antenna 215. In the present embodiment a preprogrammed set of software download options are stored in memory 240, and provided to display 225 by processor 250 on receipt of suitable input commands from a user via keyboard 230. When a user selects via keyboard 230 a chosen software download, processor 250 processes such demand and automatically initiates a call to MSC 120 which is established in conventional fashion by radio link 122 through BSS 110. Alternatively, such a call can be set up manually by the user using keyboard 230.

The processing steps carried out by MSC 120 in processing the plurality of requests of the type described above from a plurality of user stations will now be described with reference to Figure 3. The requests are forwarded to the database 140 in MSC 120, which thereby implements step 310 of receiving the requests. MSC 120 further comprises a processor 150 that is coupled to database 140.

Processor 150 analyses the received requests, and at step 320 forms, for each transmission coverage area, separate request groups for each specific package of software requested. In the present example, the transmission coverage area consists of the cell, i.e. the coverage area served by BSS 110. Processor 150

further determines the number of requests received for each package of software. Processor 150 also determines and maintains an ongoing record of how long any such request has been held. In particular, processor 150 further determines which waiting time is the longest time amongst the set of requests it holds for a particular package of software. Such a procedure is repeated at regular intervals, and after each interval the current status for each set of software is input into database 140.

Using the ongoing results of the above analysis, processor 150 repeatedly carries out step 330 of determining when to transmit the data as follows. At each update of the above described information, processor 150 compares the maximum time that any of the requests have been held against a threshold value defining the maximum time allowed for any one request to be held before transmission should occur. The value of the threshold is input previously by the operator of the cellular communications system. Processor 150 also compares the number of requests in the particular request groups against a further threshold, again preset by the operator of the cellular communications system, defining the maximum number allowed to be held before transmission should occur. If neither of the thresholds have yet been met, the requests remain held in the database 140 and no transmission takes place. However, on either or both of the thresholds becoming met, then processor 150 determines to carry out transmission.

The above described processing operation can further be understood by reference to Figure 4 which schematically illustrates the processing information employed by processor 150. A typical example of ongoing request values is shown in table 410 as being held in database 140. In table 410, four types of software package that have been requested are labelled as A, B, C, D. Typical ongoing values of the number of requests received for such software packages are shown in the second column of table 410 and an

ongoing maximum waiting maximum time that any one request has been held in the database is shown in the third column of table 410. Also schematically shown is how such information is compared by processor 150 with the maximum threshold 420 defining the number of requests that can be held for each software package type and the separate threshold 430 defining the maximum permitted waiting time for any one request.

In the example shown in Figure 4, the threshold values are the same for each software package. The threshold of the number of requests at which transmission should be implemented is 25. The threshold of the waiting time at which transmission should be implemented is thirty minutes.

Processor 150 determines that software package A should not yet be transmitted, as neither threshold has been reached. However, processor 150 determines that software package B should be transmitted because the maximum waiting time threshold of thirty minutes has been met. Similarly processor 150 determines that software package C should be transmitted because the number of requests held has reached the threshold value of 25. It can also be seen that software package D has no requests outstanding, illustrating that software package D has just been transmitted and processor 150 has consequently removed the satisfied requests from the database 140.

In the present example both software packages B and C are required to be transmitted. The transmission of software package B will now be described, it being noted that software package C is transmitted in the same way. Processor 150 forwards details of those user stations that requested software package B to BSS 110, along with the actual content of the software package B. At step 340, in preparation for transmission of the data forming the software package to the relevant user stations via a common transmission resource, BS 110 first pages those user stations. BS 110 informs each such user station, via a short

term dedicated point-to-point link, of transmission details of the forthcoming common transmission, which will be point-to-multipoint. The cellular communication system of the present embodiment operates on a conventional Time Division Multiplex Access (TDMA) basis, and the initial point-to-point paging and transmission of preparation information is carried out using conventional channels. The preparation information sent by BS 110 includes details of the time the common transmission is to occur, as well as details of the channel that will be used for the common transmission. Other information, such as encryption details or similar details can also be sent. The user stations process the preparation information under the control of their processors 250.

In the present example, at step 350 of Figure 3, BS 110 transmits the common transmission comprising the data forming the required software package in predetermined timeslots of a broadcast control channel. The preparation information will accordingly have informed the user stations to extract the required information from the identified part of a common broadcast control channel which each user station is already programmed to respond to. Thus, each user station receives and extracts the common data. It will be appreciated that the present invention is not limited to the use of part of a broadcast control channel, rather a number of other possibilities of the exact point-to-multipoint transmission method can be implemented according to the requirements of the particular system under consideration. Indeed, any appropriate physical or logical channel can be used to implement delivery of the same information to a plurality of users. Other examples include the use of a conventional downlink channel in a TDMA system, with appropriate adaptation of signalling and handshake protocols to facilitate a plurality of the user stations accessing the same channel. Another example is that specific timeslots, other than those of the broadcast control channel, can be allocated to the common transmission from a TDMA frequency. Similarly a specific downlink channel in a CDMA cellular communications system can be employed. Another alternative is to

employ a specific transmission frequency, or a specific transmission frequency hopping plan.

In the present embodiment, the transmitted item of data is a specific software package. As the transmitter/receiver means 220 of the software defined radio user station receives the data, it passes it to the modem 245 which converts the data into a form in which processor 250 can adapt the functionality of the software defined radio according to the newly received software.

A number of variations or optional improvements to the above described first embodiment are possible. In one simplified form of the embodiment, the step 330 in which the transmission time is determined can be omitted, and instead transmissions can be made at either predetermined regular times, such as each hour, or at any other time based on the operation of the cellular communications system, the timing of transmission effectively being independent from the details contained in the requests. Although such a simplified version will not display those specific advantages of the main first embodiment which derive from the time being determined dependant on the details of the request, nevertheless those advantages achieved by forming a request group and transmitting the same item of data by a common transmission resource will nevertheless be available from such a simplified version of the present invention.

Similarly, if predetermined common transmission resources are known by the user stations, the step 340 of transmitting preparation information can be omitted.

A refinement to the first embodiment described above is to include further information specified by the user station in the requests, the information relating to when a user station needs to receive the requested data by. In one

example, the request for a specific software package is accompanied by an indication of the maximum delay which can be accommodated before receipt of that software. In such a case, when processor 150 determines when transmission needs to take place, such a time criteria received in requests from the user stations is also employed in the decision making process in addition to the above described thresholds which are set by the operator.

A further refinement is for user specified information to include price related details, for example a maximum price the user wishes to pay. In such a case transmission will occur when the number of requests in a request group is sufficient to give a sufficiently low unit cost.

Another option is that processor 150 and database 140 can be arranged to respond to status enquiries from the user stations and thereby provide the user stations with information of the status of the requests. Such information can consist of an indication of the expected delay before transmission, i.e. involving an interpolation or forward estimation by processor 150, or can simply provide stored values such as the number of requests already held for the relevant item of information and the total number of such requests that will be required for the transmission threshold to be reached.

In another variation of the above embodiment, the fixed threshold levels employed by processor 150 are replaced by a time varying function or other algorithm. In particular, the number of requests received for a specific item of data and the maximum time any single request has been waiting can be interwoven in a functional form, e.g. the maximum permitted waiting time can be reduced as a function of increased number of requests according to a functional relationship determined according to the requirements of the system under consideration. Other ways in which the algorithm can be made adaptive are to include feedback from previous numbers of requests over previous periods of time and delays experienced by users in such previous operations.

A further option and improvement is that the details, held in database 140 and available to processor 150, about the user stations corresponding to all of the requests in a specific request group, can be employed to optimise or at least improve power control methods employed during the common transmission step. Power control methods are well known to the skilled person, and are conventionally employed in point-to-point transmissions. However, power level information ascertained from user stations due to receive the common transmission can be beneficially employed by setting the power level of the common transmission merely at a power level sufficient to meet the highest power requirement among the user stations corresponding to the request group.

In the above embodiment more than one cell can be included in the processing controlled by MSC 120, in that further base station systems or base transceiver stations connected to MSC 120 can be controlled in the same fashion as BSS 110.

In an alternative version of the above embodiment, database 140 and processor 150 can instead be located in BSS 110. In this case the compilation of user station requests is specific to one cell. In such a situation, when a user station first enters the cell, it can add its requests to the stored requests at BS 110. Similarly, if a user station leaves the cell, the request can easily be removed from the latest version of the request group held in the database 140. In such a version, the data content to be transmitted, i.e. the specific software packages in the present case, will be made available to BSS 110 by the operator of the cellular communications system, who in the present example has control of BSS 110. However, in other embodiments the items of data to be provided may be supplied by operators other than the operator in control of the cellular communication system. In such a case, the database and processor can be at

BSS 110 or MSC 120, or any other suitable location, whereas the specific items of data are input, by the provider of the data, into the arrangement shown in Figure 1 via PSTN 130.

A second embodiment will now be described with reference to Figure 5. Figure 5 schematically illustrates a cellular communications system based on packet data handling. The system is compatible with the Universal Mobile Telecommunication System (UMTS) currently under standardisation. Again many user stations are involved in the present embodiment, and again only three are illustrated for representative purposes. The user stations can consist merely of mobile telephones 502, 504 and 506, however in the present embodiment the mobile telephones are coupled to further items as will now be explained. Mobile telephone 502 comprises means for communicating over a communication link 562 with an external device 572. The external device 572 can in principle be any device not an integral part of the mobile telephone, but is preferably a computer or an electronic organiser. Alternatively the external device can be a Smart card, such as a Subscriber Identity Module (SIM) card used in cellular radio communications systems. The communication link 562 is preferably a fixed cable connection with appropriate interfaces built into the mobile telephone and the external device, but other communication links such as infra red or radio links can be used. Alternatively the whole user station can be of a mobile form by being constituted of a pci card or other card plugged into a computer and serving as a radio modem. Similarly a further alternative is a portable computer with a radio built in. All of these arrangements are particularly relevant in a packet switched system such as UMTS which offers increased potential for multimedia and Internet use. Mobile telephone 504 is similarly connected to an external device 574 via communication link 564, and mobile telephone 506 is connected to an external device 576 via communication link 566.

In the present embodiment mobile stations 502, 504 and 506 communicate with

base station system (BSS) 510 of the cellular communications system over radio links 522, 524 and 526 respectively. BSS 510 is coupled to a Mobile Packet Switch (MPS) 520 which itself is connected to a Public Data Network (PDN) 530. In the present embodiment a database 540 and a processor 550, corresponding to the database 140 and processor 150 of the previous embodiment, are located in MPS 520. In the present embodiment processor 550 and database 540 operate in corresponding fashion to the processor and database of the first embodiment. In the present embodiment the items of data requested by the user stations consist of specific information, such as news items, travel information, leisure information and so on, which are provided by a separate data provider 580 which inputs the required information into the PDN 530 via a suitable interface 585. In the present embodiment such information is in multimedia forum, the interface consists of a modem, and the data provider has produced the information content on a computer system.

In other versions of the present embodiment such an interface could be coupled directly to MPS 520. One scenario in which direct input into MPS 520 will occur is when a particular data provider has a commercial agreement with a particular cellular radio communications network operator having control of, or access to, MPS 520.

The cellular communications system of the present embodiment is based on packet data handling. This aspect can be exploited in the choice of common transmission resource, in that the required data can be contained in packets with given header identities. In order for the relevant user stations to extract the data, they are merely informed of the header identities of the relevant packets.

Furthermore it is to be appreciated that the present invention is applicable to other

varieties of network configurations and network components, arranged in different hierarchical, access and interconnection formats, in data handling communications systems such as UMTS. As such, the route via which the data provider will provide the data service to the ultimate end user stations in other versions of the present invention will be chosen by the skilled person according to the particular characteristics of each overall network arrangement, and similarly the location of the interface 585 will be chosen according to the particular characteristics of the overall network arrangement and the nature of the network components.

The various options described in relation to the first embodiment above can be applicd also to present second embodiment.

In another version of the embodiment shown in Figure 5, data provider 580 is arranged to provide the required data to PDN 530 via an information network, for example the Internet. Other information networks which can be employed include restricted access networks and private networks.

A different embodiment of the invention addresses the situation where a large number of users require data which is identical, to data which has already been accessed, is similar, related to or associated with such data. Under current systems, this still requires separate and independent requests and data accesses to be made. If too many accesses for the same data are made, then the system can become overloaded and either access time becomes very long, or data gets lost or some users can not obtain the data or loose connections. This is highly unsatisfactory.

If a number of users of user stations are situated in the same location and undergoing the same conditions, then there is quite a likelihood that they would

seek similar information. One example is in a traffic jam. Thus, the user of a user station may access first website 1 which includes breakdown service details. Another user, or the same one may access a second website 2 which lists local hotels which has online booking facilities. Access may also be made to website 3 which includes video feeds from video cameras ahead or website 4 which refers to local weather conditions.

In embodiments of the invention, the base station analyses the various requests for information and determines when the same information, similar information or information which is related to information which has been accessed earlier or concurrently being accessed is desired. Upon determining this information, a local copy of that information is stored in a cache memory. So, in the situation mentioned local copies 1' 2' 3' 4' of websites 1,2,3,4 respectively are stored. Each subsequent attempt by a user station to locate one of these items of information can then result in information being supplied directly from a local cache rather than having to make separate connections to the internet.

The processing at the base station most preferably groups the information logically. For example it may be grouped by type of information (traffic, videos, hotel booking, etc). When a request for further access for the same or similar information from new users is received then this is preferably replied to by sending a list of these grouped categories. These are then displayed on the screen of the user station.

For example the following five groups of information can be shown. These are a) traffic information, b) a link to a video cam at a further junction down the highway motorway, c) links to sites where users can choose which video camera they wish to view an image from, d) links to a weather website and e) links to a

hotel booking service. The display indicates to the user that these groups are active and the user can, by scrolling up and down or direct entry, select one of these categories to view. In this case, he has expressed a preference to view traffic information. By clicking, or otherwise indicating his preference, the base station then sends the relevant information from its local cache.

Alternatively, the user can ignore the grouped categories and can continue to request his own independent search or to search for other information.

Various other services can also be offered.

In one example, information can be broadcast to all those users who are subscribed to a particular group (ie who have indicated an interest in obtaining information of a particular group category). This could indicate, for example, that a new user should not try to connect at a particular point in time since the network is busy.

Users of similar group services therefore become members of a group, which is formed at a particular time and then disbanded when a need for the information goes. It is possible to arrange that group members can communicate with each, by data messaging or by voice, by means of the local loop formed via the base station. To achieve this, the logic of the base station may generate a list of the users forming a particular group and enables connection (which may of course be by a software based implementation) within the base station, which allows the users to communicate directly with one another. This can be very useful for users in a common situation, particularly in an emergency situation.

The users need not be proximal to each other. If there is a particular event or

situation about which a large number of users who are geographically dispersed require similar information generally concurrently, then similar concepts apply and the invention is applicable here.

The present invention allows efficient use of network capacity as well as providing information that people need, when they need it. In addition, many useful group – based services can be supplied to those in and those joining a group. A particular advantage of the invention is that by viewing a list of local groups, a user may become aware of services, the existence of which he was not aware of before.

User groups can, albeit unwittingly, help each other to make the most of the limited capacity available with a communications system or network.

The present invention is particularly advantageous in variable bandwidth systems, as the operator can choose the required bandwidth as a function of the number of requests, and so on.

In the above embodiments, database 140 and processor 150 can be replaced by other technical means achieving the same or equivalent functions. Moreover processor 150 and database 140 can be located at locations other than those described above. They can alternatively be located in other components shown in the above described systems, at dedicated remote locations, or can be implemented in the form of various different parts distributed at more than one location or component within an overall system. Processor 150 can be implemented in the form of software running on a suitable processor such as a microcontroller or digital signal processor, or can be implemented in the form of specifically designed hardware or a combination of hardware and software. The

processor can be controlled by processor-implementable instructions, for carrying out the method steps described in the above embodiments, which are stored in a storage medium. The storage medium can be a disk, e.g. floppy disk or hard disk, memory such as RAM, or any other appropriate medium. Alternatively the processor can receive the instructions via a signal carrying the processor-implementable instructions. Furthermore, in the above description, the terminology 'cellular communications system' is to be interpreted as describing any suitable parts of a cellular communications system infrastructure and/or network and/or management components that can be arranged to perform the described functions.

We claim

1. A method of transmitting data in a cellular communications system, the method comprising:

receiving requests for data from a plurality of user stations, said requests specifying an item of data required;

forming a request group consisting of those requests that specify a same or substantially similar item of data; and

transmitting said same or substantially similar item of data via a common transmission resource to said user stations corresponding to said requests in said request group.

2. A method according to claim 1, further comprising a step of determining, according to a number of requests in said request group, when said transmitting step is performed.

3. A method according to claim 1, wherein said requests further specify one or more transmission time criteria, the method further comprising a step of determining, according to a transmission time criteria specified in said requests in said request group, when said transmitting step is performed.

4. A method according to claim 1, wherein said requests further specify one or more transmission time criteria, the method further comprising a step of determining, according to said number of requests in said request group and said one or more transmission time criteria specified in said requests in said request group, when said transmitting step is performed.

5. A method according to claim 1, wherein said common transmission resource is at least one of a following group:

(a) a specific downlink channel in a time division multiple access cellular communications system;

(b) specific timeslots in a time division multiple access cellular communications system;

(c) a specific downlink channel in a code division multiple access cellular communications system;

(d) a specific transmission frequency;

(e) a specific transmission frequency hopping plan;

(f) partial capacity of a broadcast control channel.

6. A method according to claim 3, wherein said transmission time criteria includes a maximum waiting time specified by a user station.

7. A method according to claim 1, wherein said transmitting step is performed at a time determined according to an algorithm, preferably an adaptive algorithm.

8. A method according to claim 1, further comprising a step of transmitting information to said user stations on an individual basis prior to said common transmission, for preparing said user stations for said common transmission.

9. A method according to claim 1, further comprising a step of providing one or more of said user stations with information of a status of its request.

10. A method according to claim 1, further comprising a power control step in which a power transmission level of said common transmission resource is determined according to a highest transmission power level required by a user station corresponding to a request in said request group.

11. A method according to claim 1, wherein requests are added to or removed from said request group responsive to a user station moving respectively into or out of a cell of said cellular communications system.

12. A method according to claim 1, wherein said user stations are software defined radios and said item of data is software to be downloaded.

13. A method according to claim 1 wherein the substantially similar item of data is localised stored.

14. A method as claimed in claim 1 comprising transmitting information relating to substantially similar item of data to one or more mobile terminals.

15. A method as claim in claim 11 wherein a user stations is adapted to select an item of said similar item of data in response to the information transmited, and subsequently to request that data.

16. An apparatus for transmitting data in a cellular communications system, said apparatus comprising:

means for receiving requests for data from a plurality of user stations, said requests specifying an item of data required;

means for forming a request group consisting of those requests that specify a same or substantially similar item of data; and

transmitting said same item of data via a common transmission resource to said user stations corresponding to said requests in said request group.

17. An apparatus according to claim 16, further comprising means for determining, according to a number of requests in said requests group, when said item of data is to be transmitted.

18. An apparatus according to claim 16, wherein said requests further specify one or more transmission time criteria, said apparatus further comprising means for determining, according to said one or more transmission time criteria specified in said requests in said request group, when said item of data is to be transmitted.

19. An apparatus according to claim 16, wherein said requests further specify one or more transmission time criteria, said apparatus further comprising means for determining, according to a number of requests in said request group and said transmission time criteria specified in said requests in said request group, when said item of data is to be transmitted.

20. An apparatus according to claim 16, wherein said common transmission resource is one of a following group:

(a) a specific downlink channel in a time division multiple access cellular communications system;

(b) specific timeslots in a time division multiple access cellular communications system;

(c) a specific downlink channel in a code division multiple access cellular communications system;

(d) a specific transmission frequency;

(e) a specific transmission frequency hopping plan;

(f) partial capacity of a broadcast control channel.

21. An apparatus according to any of claim 18, wherein said transmission time criteria includes a maximum waiting time specified by a user station.

22. An apparatus according to claim 16, wherein said transmission time determining means comprise means for determining said time at which said item of data is to be transmitted according to an algorithm, preferably an adaptive algorithm.

23. An apparatus according to claim 16, further comprising means for transmitting information to said user stations on an individual basis prior to said

common transmission, for preparing said user stations for said common transmission.

24. An apparatus according to claim 16, further comprising means for providing one or more of said user stations with information of a status of its request.

25. An apparatus according to claim 16, further comprising power control means for determining, according to a highest transmission power level required by a user station corresponding to a request in said request group, a power transmission level of said common transmission resource.

26. An apparatus according to claim 16, further comprising means for adding requests to or removing requests from said request group responsive to a user station moving respectively into or out of a cell of said cellular communications system.

27. An apparatus according to claim 16, wherein said user stations are software defined radios and said item of data is software to be downloaded.

28. An apparatus according to claim 16, wherein said apparatus is adapted to locally store said same or substantially similar item of data.

29. A method of transmitting a request for data, wherein the request is compatible with the method as claimed in claim 1.

30. A method of receiving data which has been transmitted according to the method as claimed in claim 1.

31. Receiving apparatus adapted to transmit a request for data, wherein said request for data is as defined in claim 1.

32. Receiving apparatus adapted to receive data as transmitted via transmitting apparatus according to claim 13.

33. A storage medium storing processor-implementable instructions for controlling a processor to carry out the method of claim 1.

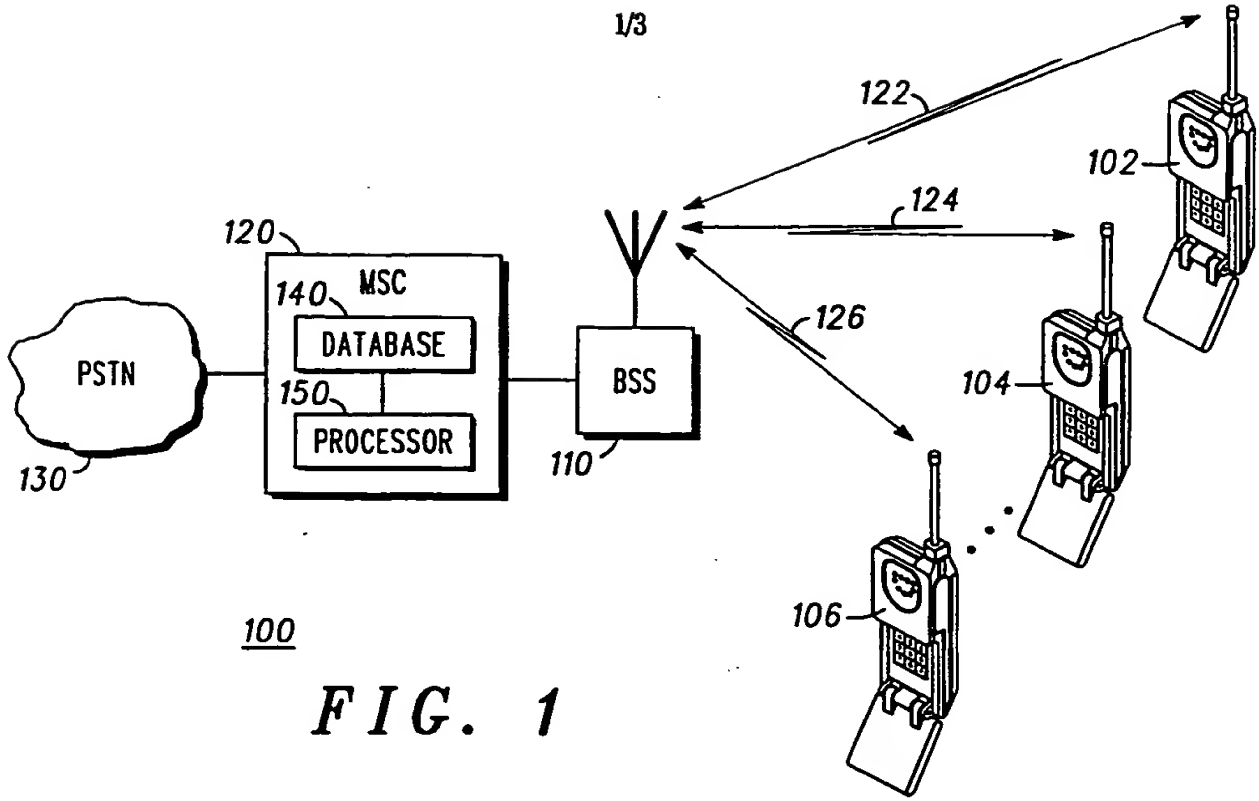


FIG. 1

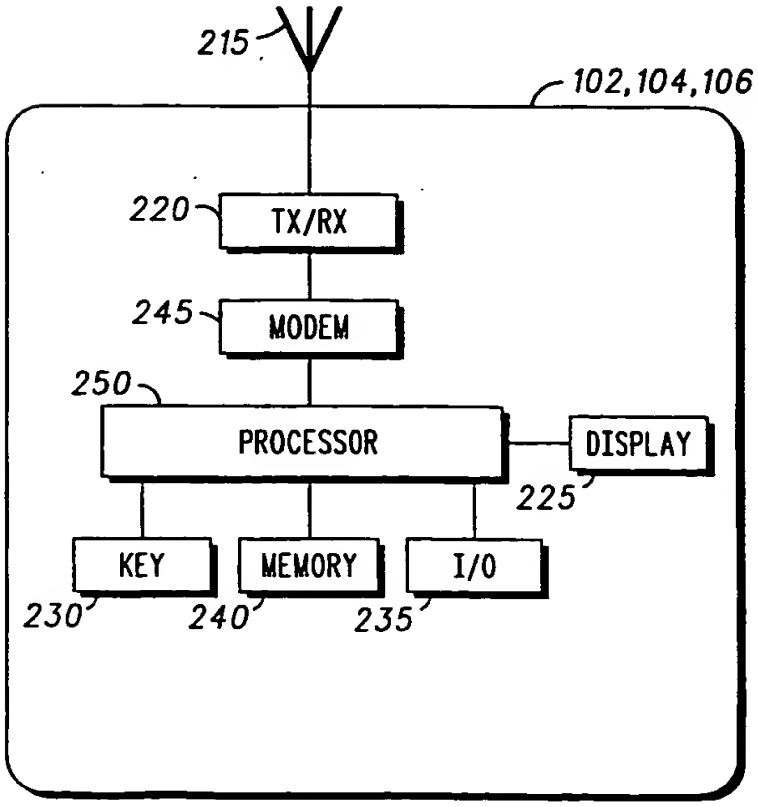


FIG. 2

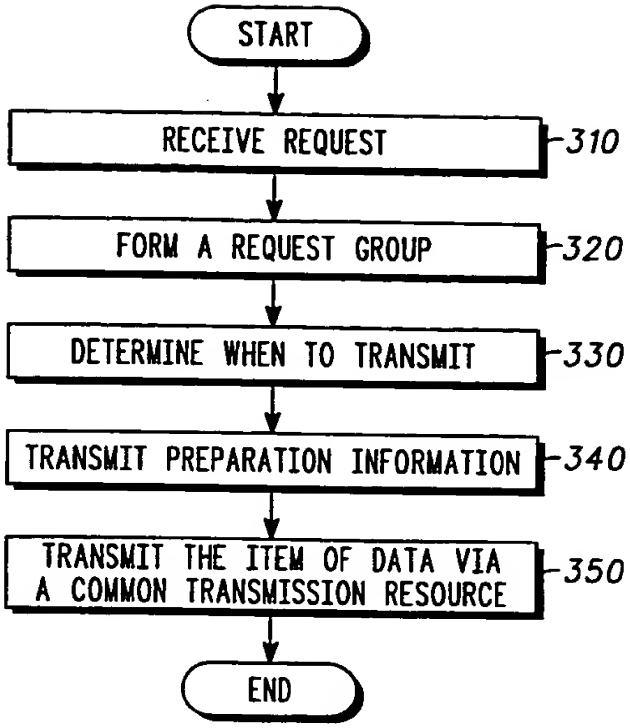


FIG. 3

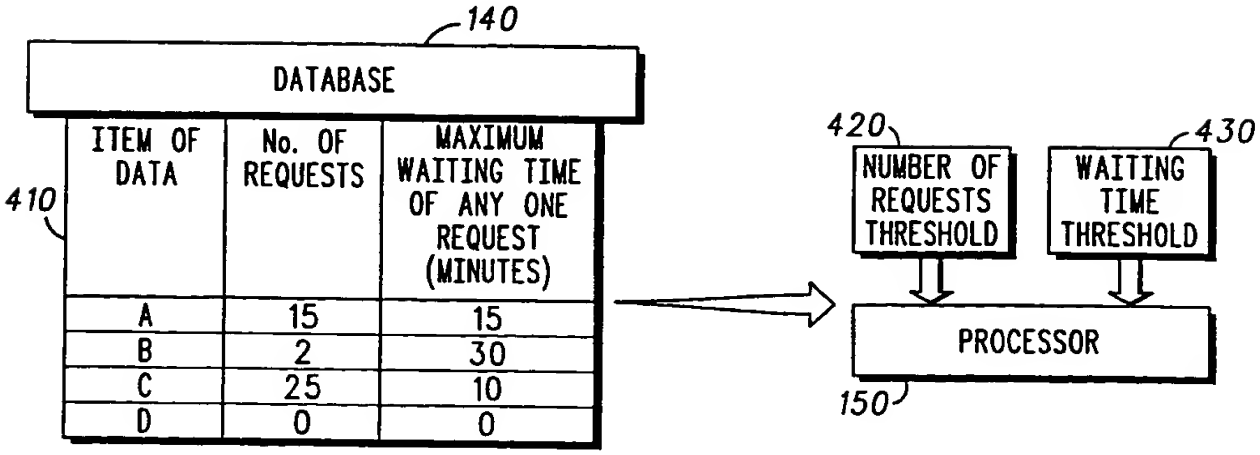
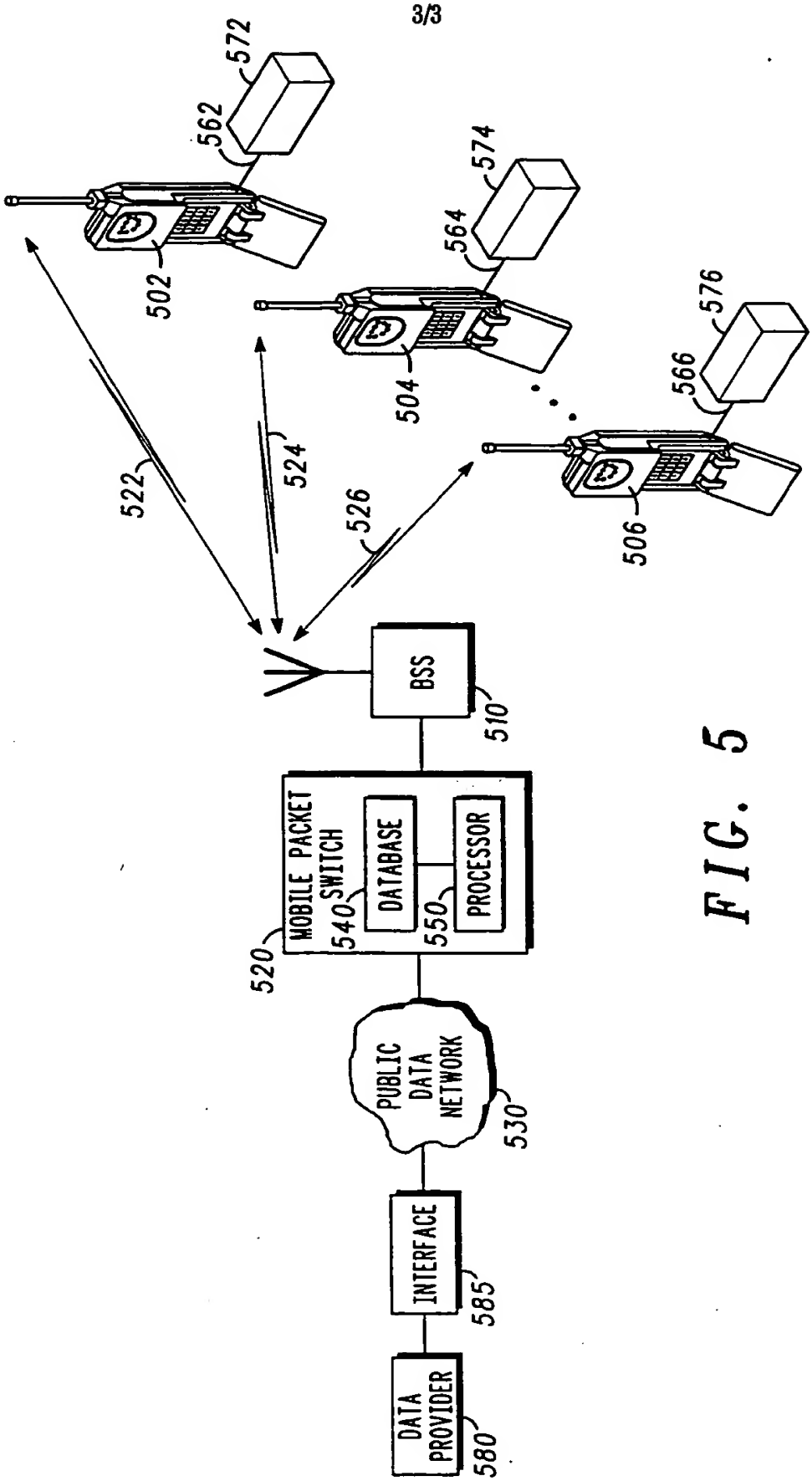


FIG. 4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BSS
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MOBILE PACKET SWITCH
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DATABASE
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PROCESSOR
550
PUBLIC DATA NETWORK
530
INTERFACE
585
DATA PROVIDER
580

FIG. 5

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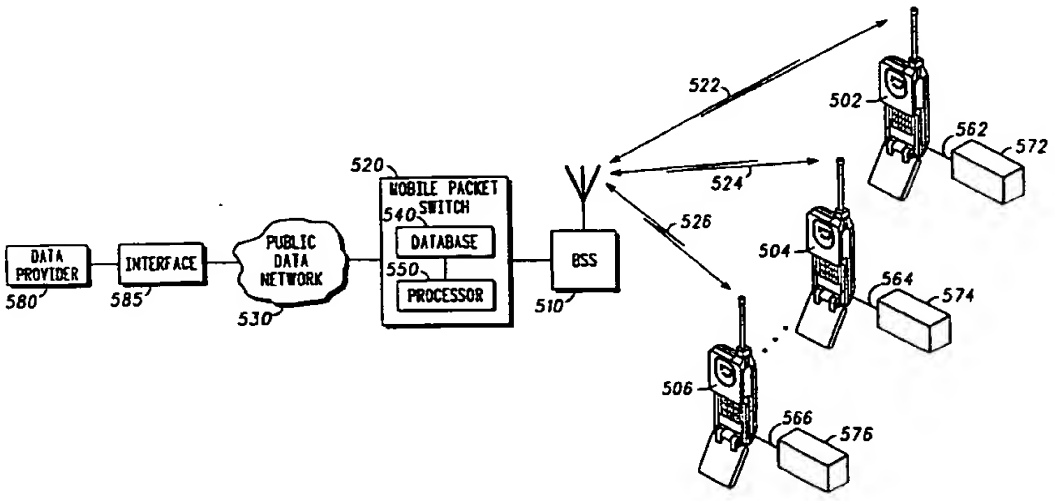
[Continued on next page]

(54) Title: DATA TRANSMISSION IN A CELLULAR COMMUNICATIONS SYSTEM



(57) Abstract: A method of transmitting data in a cellular communication system. The method includes receiving requests from a plurality of user stations, forming a request group consisting of those requests that specify a same item of data, and transmitting the same item of data by a common transmission resource. A transmitting step can be performed at a time determined according to a number of requests in the request group and/or transmission time criteria specified in the requests. Also described is a corresponding apparatus for transmitting data. Also described is a storage medium storing processor implantable instructions. The invention reduces the amount of transmission resource used.

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According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 98 23050 A (ERICSSON GE MOBILE INC) 28 May 1998 (1998-05-28) page 8, line 15 -page 9, line 15 page 10, line 7 -page 12, line 9 page 13, line 16 -page 15, line 10 page 20, line 1 - line 12 --- -/--	1,4,5, 7-9, 11-16, 19,20, 22-24, 26-33

[X] Further documents are listed in the continuation of box C.

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INTERNATIONAL SEARCH REPORT

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Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	LEE M J ET AL: "PERFORMANCE IMPROVEMENTS OF WIRELESS IP MULTICAST CONFERENCE SYSTEMBASED ON DESIGNATED RECEIVERS" ATLANTA, GA, JUNE 7 - 11, 1998,NEW YORK, NY: IEEE,US, vol. CONF. 5, 7 June 1998 (1998-06-07), pages 807-811, XP000890984 ISBN: 0-7803-4789-7 page 809, left-hand column, line 7 -page 810, left-hand column, line 23 ---	1-9,11, 13-24, 26,28-32
E	EP 1 063 782 A (NIPPON ELECTRIC CO) 27 December 2000 (2000-12-27) page 5, line 52 -page 6, line 3 page 6, line 34 -page 7, line 32 -----	1,10,16, 25

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9823050 A	28-05-1998	US 6128483 A	03-10-2000
		AU 5441698 A	10-06-1998
EP 1063782 A	27-12-2000	JP 2001007759 A	12-01-2001